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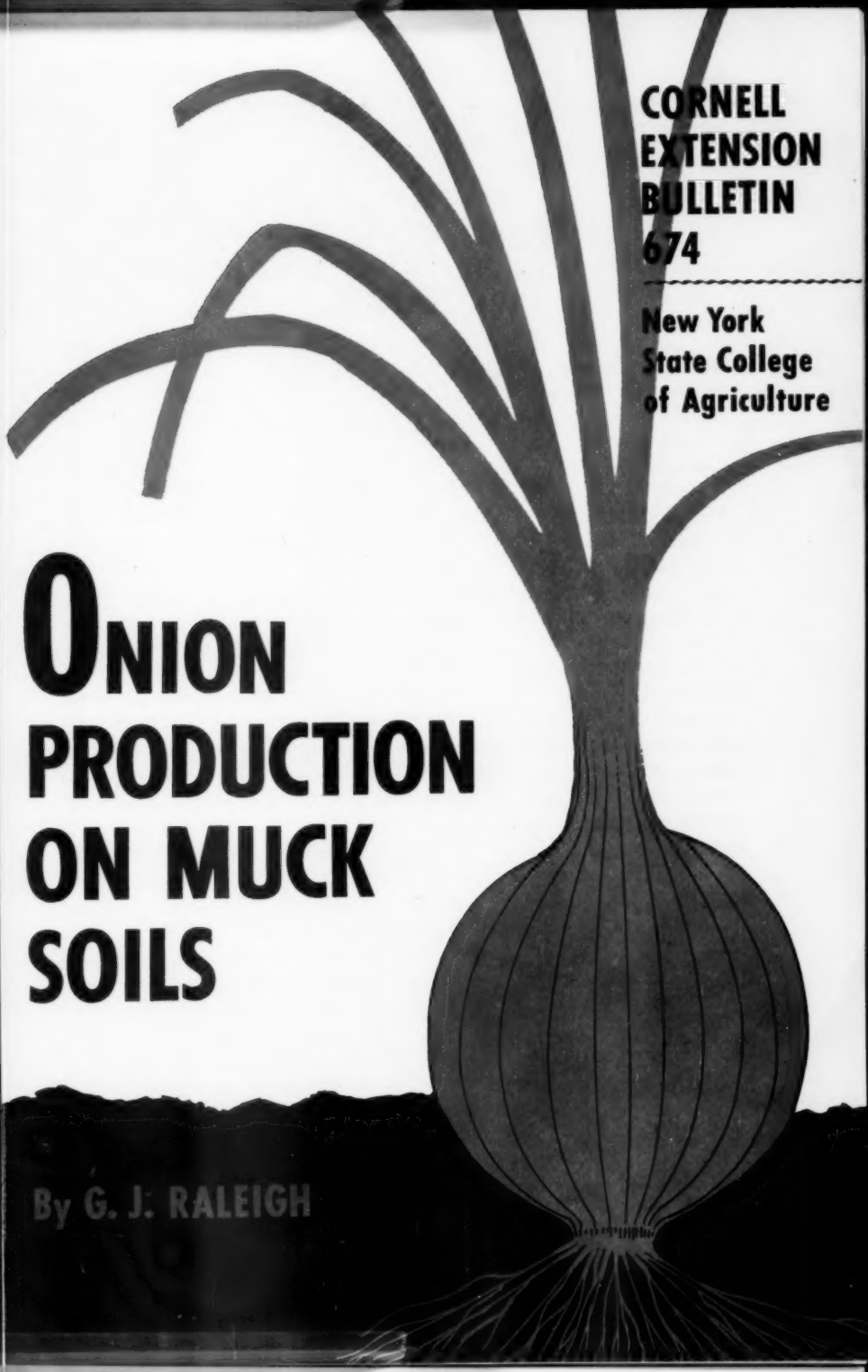

ONION PRODUCTION ON MUCK SOILS

By G. J. RALEIGH

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Onion Production on Muck Soils

G. J. RALEIGH

ONIONS are of many types and varieties. Those that grow well in the latitude of New York State are subject to a wide range in yield because of differences in temperature, soil moisture and sunshine. Excessive heat or lack of adequate soil moisture may result in early bulbing and low yields. Very cloudy weather may cause soft growth and susceptibility to disease.

In New York State the onion is the most important crop grown on muck soils. About 14,000 acres of onions are grown in the state. Orange County leads with about 6500 acres. The Genesee-Orleans County area has about 3300 acres. Oswego and Madison Counties each have more than 1000 acres. The remaining acreage is largely in Wayne and Steuben Counties.

The high cost of onion production makes it imperative to grow onions only on soils that will produce high yields. Muck soils, because of their fertility, their water supplying capacity and their loose texture, are particularly well adapted to the production of onions. High yields are possible on well chosen mucks. Few mature onions are produced from seed on the mineral soils of the State because growing conditions are less favorable.

Since 1949 growers have gradually increased yields by spraying to control blast and mildew which often have reduced yields markedly in humid areas. In addition newer methods of control for onion maggots and thrips have reduced hazards to good production. Chemical methods of weed control have cut costs of production for many growers. As a result of these advances, average yields have increased faster than acreage has been cut in spite of an average reduction in states producing the late onion crop of about 10,000 acres in the past ten years. Consequently the industry has had to go through many years of very dull markets. These advances have placed muckland onion growing in a good competitive position, however. New York State continues to maintain its place as the leading onion producing state.

FIGURE 1. This onion field was ruined by mildew in late July. An adequate spray program to control mildew and blast would have saved this crop.

STRIVE FOR EFFICIENCY

There is every evidence that onion production will continue to be a very competitive business and that there will be gradual elimination of acreage that cannot be made to produce high yields at relatively low costs. Machinery is playing an increasingly important role in progress. In ten years the garden tractor has been practically discarded for heavier tractors that do more work and make the task easier. Increasing length of rows adds greatly to efficiency, but that efficiency should never be purchased at the expense of drainage.

SELECTING SUITABLE MUCK

The desirability of muck for onion production is largely determined by its drainage, its depth, its reaction or pH, and by its relative freedom from weeds.

Drainage

Early planting is important to obtain good yields of onions. Land that does not drain well and remains wet in the spring or is subject to flooding is not likely to be profitable for onion production over a period of years. Drained muck decomposes and settles with time. Many fields satisfactorily drained a few years ago are now too wet.

FIGURE 2. Broken tiles caused wet spots in this onion field.

It is impossible to tell by looking over an area how much fall is required to allow water to drain from a muck. Surveying the muck to determine how drainage may be obtained is a job for an engineer with experience. Consult your county agricultural agent or agricultural engineer before attempting a major drainage project.

Depth of Muck

Mucks less than three feet in depth are more subject to drought than are deeper mucks. Shallow muck may settle to the point where marl, which underlies the muck, may be plowed to the surface and incorporated in the muck, making the soil alkaline and possibly rendering some of the minor elements unavailable to the plants.

Reaction, or pH

Onions may not grow well on mucks more acid than pH 5.2. Some mucks of that pH produce large yields. If growth is poor, an application of one ton of ground limestone is suggested. An additional ton is needed for each drop of one tenth (0.1) on the pH scale. If the muck is as acid as pH 4.8 and four tons of lime are required, one-half of the limestone may be plowed under and the remainder worked into the surface soil. Applications greater than five tons per acre are not suggested for any one season.

Weeds

Soil free from excessive numbers of weed seeds is one of the most important requirements for profitable onion production. The onion competes poorly with weeds because the top grows slowly and does not shade the young weeds enough to check their growth. Many of the onion fields that must be replanted during wet seasons are on muck soils where weeds have been allowed to seed profusely in the past.

Weeds are usually troublesome near the spot where the plant that produced the seed grew in previous years. This is best illustrated by the number of weeds near the hedge or road as compared with the number in the middle of a muck field. The best way to assure a continued reduction in the number of weeds is to prevent weeds from seeding on the muck. Unfortunately, enough seed can be produced in one year to cause trouble for years, because the weed seed may remain viable for years. It is often a hard choice to use labor late in the season to remove the small weeds that have escaped to that time and are not of consequence so far as the season's crop is concerned, but the removal of such weeds is the one best way to reduce the cost of weeding in future years.

There are farms in the state on which no weeds have seeded for ten to twelve years but on which large numbers of purslane must be destroyed each year because the supply of viable seed in the soil has not yet been exhausted.

PREPARING THE SOIL

Fall plowing of the muck is common practice for onion growers, chiefly because seeding may be made early in the spring. Most muck is plowed to a depth of about eight inches. It is advisable to plow only a small amount of the coarse underlying muck during any one season.

In the spring, fertilizer is broadcast and disced deeply into the muck. Loose muck is usually rolled as well as floated. Floating should be done carefully to leave a relatively firm and level seedbed.

Fertilization

There is a wider range of practices in the fertilization of onions than for most other muck crops. Most of the experiments with onions on muck that has been fertilized for ten years or more have shown little response to phosphate and potash fertilizers. Onions on older mucks are more likely to need nitrogen than are onions on mucks that have been cleared recently. The age of muck may not be a wholly reliable guide in determining the need for heavier nitrogen applications. Some old mucks may supply nitrogen better than others that have not been cleared for so long a period.

There is widespread opinion that the use of average quantities of nitrogen in a fertilizer may produce onions of poor keeping quality. This is true in tests conducted in the greenhouse under the poor sunlight conditions of winter. Field experiments do not indicate much danger from relatively heavy applications of nitrogen made at the time of seedbed preparation. During seasons when nitrification is poor and leaching is excessive because of heavy rains, sidedressing is likely to prove profitable on most mucks except those that have been recently cleared.

In recent years soil testing methods have become more reliable and it is advisable for growers to know the levels of nutrients in their muck as well as its pH. When tests indicate a desirable pH range, high levels of phosphorus and potassium and low levels of undesirable iron and aluminum, a fertilizer such as 10-10-10, used at a rate to supply nitrogen equivalent to that provided by previously used fertilizers, may give as good yields at a considerable saving in fertilizer costs. In weighing the value of fertilizer it is important to keep several points in mind. Fertilizer costs are a relatively small part of total costs on our best mucks. The range of yields in onions is very wide. It is difficult to determine accurately differences in yields by comparing fields or even large unreplicated blocks in one field.

On newly cleared muck a high analysis fertilizer that is low in nitrogen is suggested.

Copper and Manganese

Mucks that produce onions with thin, poorly colored skins should receive an application of 300 pounds of finely ground copper sulfate. This may be applied separately or mixed with the fertilizer. Mixing the copper sulfate with the fertilizer may assure more even distribution because many growers do not have the equipment to apply small quantities. Uniform distribution is necessary. Additional copper sulfate should not be applied until its need is indicated by poorly colored bulbs. The use of copper does not solve all of the problems involving poor scale color or scale retention. If considerable copper has been used it is improbable that more will give added advantage.

Many mucks, especially those higher in pH than 6.0, may produce increased yields if manganese sulfate is used at a rate of 150 to 200 pounds to the acre. Manganese deficiency is usually indicated by a gradual yellowing of the tops of the onions, especially of the older leaves. During some seasons the application of manganese sulfate with the fertilizer to supply 150 pounds to the acre may not completely control the yellowing because the manganese is rendered unavailable to the plants before the end of the growing season.

Because most growers are now spraying onions to control insects and diseases, the use of manganese in the spray offers a cheap way of controlling manganese deficiency that may occur after the manganese applied with the fertilizer has been made unavailable. Although the need for spraying onions to control blast and mildew has been demonstrated beyond doubt, the returns vary with conditions and it is difficult to measure whether the effectiveness of the fungicide is reduced by the addition of minor elements. Growers on high marl muck are likely to get more benefit from the manganese than they are likely to lose from a possible reduction in the effectiveness of the fungicide. Some fungicides contain manganese. Their relative value in comparison with cheaper fungicides to which manganese has not been added is not definitely known.

Any question concerning deficiencies of copper, of manganese, or of any other element, should be referred to the county agricultural agent.

SEED, SET ONIONS OR TRANSPLANTS

Most onions produced on the muck soils of New York are grown from seed. The proportion of the total crop so grown is increasing each year. On muck well suited to the production of onions, seed onions will produce, on the average, larger yields at lower cost than will onions grown from sets. Newer spraying programs have greatly increased seed yields in comparison with yields from sets. Set onions mature at a slightly earlier date than seed onions and so may escape unfavorable dry weather. This may be important especially on shallow mucks. Because of diseases and insects, it is better if seed and set onions are not produced on adjacent muck.

Planting Set Onions

For best results it is advisable to use sets of average size (from one-half to three-fourths inch in diameter). Small sets may produce weak plants, and large sets may produce plants that seed prematurely. Large sets may be used if they have been stored at 32°F. Those stored at slightly higher temperatures (40° to 50° F.) produce more seeders than sets stored at temperatures of 60° to 70° F., but these high temperatures are not satisfactory because the sets shrivel badly. Sets are planted as early in the spring as the soil can be worked satisfactorily. From 15 to 25 bushels are required to the acre. Machines for planting sets have replaced costly methods of hand planting.

Sets for use in the following year may be grown by seeding heavily, usually in well drained upland soil, at the rate of 60 to 90 pounds to the acre. The heavy seeding produces early bulbing and sets of the desired size. Irrigation is

desirable for the sets may be too small if the season is dry. Sets properly grown can usually be cured during early August. The growing of sets is subject to the same disease and insect hazards as is the production of the onion crop from seed.

Seeding Onions

Most growers now use power operated multiple-row seeders. Such outfits save much labor and get the job done at an early date, an important consideration in onion production. Early planting should be at a depth of one-half to three-fourths inch. Later seeding, when the muck may dry, should be slightly deeper. Four pounds of seed of good germination is the average standard rate for an acre. Growers using weed control methods that are likely to decrease stands may wish to increase the rate of seeding. Some chemicals used for weed control are more likely to reduce stands severely if seed of low vigor is used. Spraying programs that control blast reduce the hazard to heavily seeded fields because blast is more likely to be severe in fields with thick stands than in those with thin stands.

It is important to adjust the seeders before beginning the seeding job and to check them at intervals during seeding. A little care greatly reduces the possibility of poor stands and poor yields or of excessive seeding that results in small sized bulbs that increase harvesting costs and reduce the value of the onions. It is common in May to see fields where one or more rows of onions in each width of the planter is much poorer than the others because of poor seeder adjustments.

On older muck it is usually necessary to treat the seeds to control smut and onion maggots.

Transplant Onions

In the past ten years there has been an increased acreage of onions grown from transplants on muck soils. Three different types of onions are being grown from transplants in New York State. Grano type hybrid onions such as Early Harvest are grown for the early market. Mild red onions are braided for sale in competition with imported Italian onions. The Sweet Spanish variety produces large yields of big onions. Growing the transplant crop is subject to a number of factors not encountered in production of onions from seed. Anyone interested may obtain Mimeograph VC-71, *Growing Onions from Transplants,* by writing to the Department of Vegetable Crops, Cornell University, Ithaca, N. Y.

WINDBREAKS

Onions, especially those grown from seed, make slow growth at first and are easily injured if wind blows the dry muck so that it strikes the tender plants. Large bodies of muck must be protected by windbreaks or damage may be severe, especially if the surface of the muck becomes dry relatively early in the season. One windy day may ruin acres of onions if they are not protected. In areas where wind is severe, willow windbreaks set in a line at a right angle to the most likely damaging winds have been widely used for wind protection. During the early stages of onion growth additional protection is obtained by two lines of snow fences spaced at intervals and running parallel to the willows. The snow fences are removed when the onions are large enough to prevent the muck from blowing. Oats seeded between some of the onion rows at onion seeding time give added wind protection. Their use is questionable unless a tillivator is available for destroying them before they crowd the onions too much. Figure 4 shows a field of onions in which the oats have been killed by the use of a tillivator. During wet seasons cutting them out with ordinary cultivating equipment is not adequate.

FIGURE 3. Oats seeded at the same time as the onions help to prevent wind injury, but will check onion growth in adjacent rows if they are allowed to become too large.

FIGURE 4. Oats planted as a windbreak in this field have recently been killed by the use of a tillivator.

Windbreaks soon grow tall, and growth at the base is not enough to break the wind adequately. They must be removed and replaced at relatively frequent intervals, especially if they are not trimmed regularly to keep them within bounds. In spite of constant attention some weeds are likely to seed under the hedges and add to the problem of keeping the muck relatively free from weeds. Perhaps even more important, the willow windbreak wastes valuable land. Crops do not grow well within 15 feet of the windbreak.

In some well drained areas where potatoes are not grown in the rotation, the willow has been partially replaced by Amur River privet. Newer kinds of willows look promising for windbreak use.

After years of relative freedom from wind injury, growers often consider removing aging windbreaks and placing greater dependence on snow fences. In some fields such a plan would be satisfactory. It is well, however, to remember that windbreaks are insurance. It is impossible to install them after the wind begins to blow; it is more profitable to maintain this protection for five years without needing it than to risk a year of nearly complete loss. Onions reseeded after the initial crop has blown out may yield less and be of inferior quality. An adequate spraying program, however, makes late seeding much less hazardous than in the past.

Two things should be considered when evaluating the need for wind protection: (1) On some of the larger bodies of muck, more land has been cleared recently; with the removal of the trees, the wind has a free sweep over the muck. Such a situation adds to the problem of wind protection. (2) The shift from the use of set onions to seed onions also increases the hazard. Onions on small bodies of muck protected by trees rarely suffer from wind injury. (3) Base your judgment on a number of years of observation. In some areas snow fences and oats may give sufficient protection.

VARIETIES

The mucks in New York State are valuable. To compete with other areas an onion variety must be widely adapted to varying soil and weather conditions. It must give large yields of firm, well colored onions that retain their scales. In general, white varieties are not well suited to the humid conditions in the state.

The majority of set onions produced in the state are of the Ebenezer or Japanese variety. It forms a semi-flattened bulb with a heavy skin of medium yellow color. It is an excellent keeper. Most of the seed onions are now Early Yellow Globe, Michigan Yellow Globe, often called Brigham's Yellow Globe, or Iowa 44. All are yellow onions. Early Yellow Globe produces heavy yields but is a soft onion and a poor keeper. Selling it out of storage after is has become of poor quality has damaged New York State's reputation as an onion producing state.

Hybrid onions with much greater merit than those tried by growers in the early years of their production are now available. They promise to increase yields without reduction in quality. Three hybrids that now deserve careful consideration in New York State are Premier, Empire and Elite. Growers should keep in touch with current experiments and try out the newer hybrids.

CULTIVATION AND CHEMICAL WEED CONTROL

The chief purpose of cultivation is weed control. Because onions compete poorly with weeds, it is essential to cultivate enough to control them. The use of knives rather than of hooks or teeth on the cultivator is likely to result in a minimum of root injury to the onion plants. Strive to keep weeds from producing seed. On many mucks growers neglect to weed late in the season.

New chemicals for selectively destroying weeds in onions have greatly reduced the costs of growing onions. Some weeds are killed by very small amounts of some chemicals. If properly used, Chloro IPC does an excellent job of con-

FIGURE 5. Weeds are thriving in this field of young onions. Properly applied weed sprays greatly reduce the cost of weeding.

trolling purslane, the worst onion weed. Controlling weeds in onions with chemicals demands careful attention to details. Otherwise the onions are likely to be severely injured. Improvement in methods and in chemicals come so rapidly that it is unwise to include recommendations in a bulletin of this type. Ask your county agricultural agent for the latest recommendations.

HARVESTING

An onion growing normally becomes less firm at the neck as it matures and eventually the top falls over. During this stage and immediately thereafter food material is transferred rapidly from the top to the bulb and as a result the bulb increases rapidly in size. To obtain good yields it is advisable to allow most of this food transfer to take place before the onions are pulled. Onions that remain in the field for a considerable period after the tops have completely dried down, however, may not keep well in storage.

Onions may be topped with shears, knives or air blast harvesters. If hand topping is practiced, the most economical method is to pull the nearly dry onions with one hand and allow them to drop into the crate as the tops are sheared off.

There has been considerable diversity of opinion among both growers and buyers of onions on the merits of machine versus hand topping. Part of the objection to machine topping in the past has been the result of operating equipment under unfavorable conditions.

After topping the crates are stacked in the field until the bulbs have dried somewhat. They are then moved to easily ventilated storage sheds where they are graded and the thick necked, double, and rotted onions are discarded. Loose scales and dirt also are removed from the marketable bulbs. If onions are stacked in the field for any length of time, the top crates should be covered with some water-proof material such as asphalt impregnated paper to shed the rain but not to prevent the passage of air through the crates.

STORAGE

The successful muckland operator anticipates his problems and programs well in advance of needs. If one is planning to store onions the time to make plans is before the crop is seeded. If a grower plants a soft onion variety because he wants a big yield for anticipated early market he cannot then shift his plans and store the onions for a long period. In early April 1957 there were many Early Yellow Globe onions in storage in New York that had been carried through the winter because of very dull markets. Firm onions of better storage variety were worth four dollars per hundred pounds. The Early Yellows were worthless. Unjustified hopefulness is one of the most dangerous attitudes in the onion business. If plans miscarry because of some uncontrollable factor and onions do not have the quality to justify storage, it is logical to sell them as soon as a market can be found.

Well grown onions store well in either common or cold storage. Temperatures as near 32° F. as possible and relatively dry air are the two important requirements for storage. As mentioned previously, the Ebenezer, Iowa 44 and the Michigan Globe varieties store much better than does the Early Yellow Globe.

Since spraying seed grown onions for blast, mildew and thrips has become common practice, there has been a big increase in the amount of neck rot in storage onions—a disease that has caused losses in set onions for years. The trouble is usually much more serious during cool wet seasons like 1956 and 1958. Early seeded onions are likely to be damaged less than those seeded after May 1. This trouble is especially serious because it is impossible to detect all of the rotted bulbs when the onions are bagged for market.

New varieties have enabled early season producers of onions, especially Texas growers, to reach market earlier in the season than in the past. It seems certain

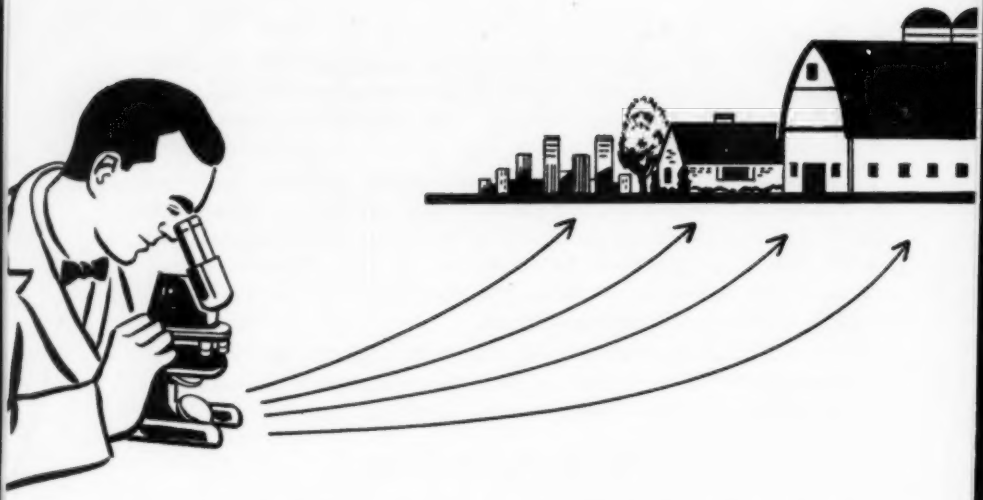
that New York growers must pay more attention to the quality of onions sold after March 1 if they are to hold their share of the onion business. Onions that are dirty and soft or that sprout before they leave the store ruin the reputation of the most important muck crop in New York.

Bulk storage of onions offers great opportunities to cut costs of production. As with any new development in a business, there is controversy concerning its merits. Much of the criticism of bulk storage comes from the storing of soft onions, inadequate equipment, poor operation of good equipment or from putting too many onions in the storage. In bulk storage the weight of the entire pile rests on the onions at the lower depths.

Growers with sufficient acreage who plan to build storage units should get the facts and decide for themselves about the various problems involved in storing onions. Consult your county agricultural agent.

INSECTS AND DISEASES

Because of the losses often caused by insects and diseases, onion growers should be familiar with control measures given in Cornell Extension Bulletin 1018, Control of Diseases and Insects of Onions. At the moment neck rot and resistant onion maggots are demanding attention. The progressive onion grower must be familiar with the latest information on all onion insects and diseases. Consult your county agricultural agent for current data.



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